

Seasonal Activity and Population Dynamics of *Mythimna separata*, *Tetrix subulata*, *Euscyrtus concinnus* and *Grylotalpa orientalis* in Rice in Relation to Meteorological Parameters

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(Received: 30 July 2023; Revised: 29 August 2023; Accepted: 24 September 2023; Published: 15 October 2023)

(Published by Research Trend)

ABSTRACT: Experiment is based on the seasonal incidence of insect's pests of rice collected through light trap device, provides useful information on monitoring of pest's activity in the field condition and fluctuation of pest population. Activity during June to October, *Mythimna separata* first appeared during 40th SW and attain its first peak in this week (7.28 moths) population was decreased from 31st to 36th SW, with a slightly increased and decreased from 37th to 40th SW, correlation studies of *Mythimna separata* revealed that evening relative humidity, minimum temperature, wind velocity, evening vapor pressure, morning vapor pressure and number of rain days showed significant negative correlation. *Tetrix subulata* was first observed in light trap during 27th SW (0.71 hoppers) population than increased sharply from 41th standard week light trap. Crucial activity period was July to October; correlation studies of *Tetrix subulata* revealed that evening relative humidity, evening vapor pressure showed significant negative correlation. *Euscyrtus concinnus* is a minor pest of paddy in Jabalpur. It was first observed during 27th SW (32.85 crickets) in light trap, population than sharply increased to attain its first and highest peak during 28th SW (213.14 crickets). *Grylotalpa orientalis* was first observed in light trap device during 26th SW. Its second and highest peak 43rd SW (8.71 cricket). The correlation studies revealed these four pest in relation to different meteorological parameters.

Keywords: Seasonal activity, Light trap, insects, Phototactic, Rice, population and Weather parameters.

INTRODUCTION

Rice (*Oryza sativa* L.) belonging to the family Graminae, is one of the most important food crops not only in India but also in the world. Rice is one of the oldest and second most intensively grown cereal crops. Rice is life and princess among the cereals, the staple food of 65% of the total population in India. It constitutes about 52% of the total food grain production and 55% of total cereal production (Kakde and Patel 2015). In Madhya Pradesh, it is cultivated on 1.76 million hectares with annual production of 3.00 million tones and productivity of 1807 kg ha⁻¹ (Anonymous, 2015). In India average losses in paddy production due to insect pests are 25-30% (Dhaliwal and Arora 2010) and in Madhya Pradesh about 40-100 % losses were observed (Dhamdhare, 1990). More than 100 species of insects are known to attack rice crop, following species of insects are more destructive in Jabalpur region Madhya Pradesh at *kharif* season (June to October) like *Mythimna seperata*, *Tetrix subulata*, *Euscyrtus concinnus* and *Grylotalpa orientalis*. Use of light trap is one of the oldest, conventional and effective method for collecting phototactic fauna and used in sustainable agriculture. Almost 20 insects are considered as rice

pests of economic importance that include stem borers, gall midge, defoliators and vectors like leafhoppers and plant hoppers etc. (Pathak and Dhaliwal 1981). Phototropic behavior and Phototactic response of insects are being largely used to monitor pest activity for their effective suppression (Dhiman, 2001). The forecasting and predication of insect occurrence or outbreak can be made by using light trap (Singh *et al.*, 2007). The innovation of this study the seasonal incidence of insect pest in rice ecosystem found variation in data of insect population in various standard meteorological week of *kharif* season. This experiment required for the monitoring of pest population, determination of pest population density and for check potential utility of light trap device as IPM tool for taxonomic documentation of insects.

MATERIALS AND METHODS

The experiment was conducted at the Krishi Nager experimental farm, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur (M.P.) during the period between the June to October, 2016, using Jawahar light trap model (SM- 96) which had mercury vapor lamp (80 Watt) was used. Seasonal activity of major rice insects was recorded on daily basis by operating the

light trap attracting device made up of 24-gauge iron sheet and collection device made of raxine, the trap was hanged on inverted 'L' shape angle iron rod. Trapping device is made up of 24-gauge GI sheet consisting of a funnel (40 cm top diameter), baffle plates each 30 × 12 cm in size and Insect collection device is made up of 24-gauge GI sheet is made up of 24-gauge GI sheet 40 cm × 40 cm × 15 cm in size with cupboard and built-in locking system.

The insects collected in the collection bag of light trap are killed by the exposure of Dichlorvos 76 EC vapor (as fumigating agent) which is directly placed in collection throughout the *Kharif* season of 2016. Daily trap catches of insects were converted into weekly total and mean per day week (week mean/day). This observation method is similar to the method adopted by Vaishampayan and Shrivastava (1977). Observations of weather data (maximum temperature, minimum temperature, sunshine, wind velocity, morning relative humidity, evening relative humidity, rainfall, morning

vapor pressure, evening vapor pressure, evaporation and number of rainy days etc.) were recorded on daily basis in the JNKVV meteorological observatory. The correlation coefficient between major rice insects and various weather parameters was calculated by using the statistical correlation regression analysis in SAS 9.2 software

(<http://support.sas.com/software/92/index.html>).

Climatic weather conditions prevalent in Jabalpur region are basically semi-arid and sub-tropical. It situated at 23.9°N latitude, 79.58° E longitude and at an altitude of 411.78 m above the sea level.

RESULTS AND DISCUSSION

Correlation coefficient of weather factors on light trap catches of *Mythimna separata* (Walker), *Tetrix subulata* Linnaeus, *Euscirtus concinnus* (de Haan) and *Gryllotalpa orientalis* Burmeister.

Weather Parameter	<i>Mythimna separata</i> (Walker)		<i>Tetrix subulata</i> Linnaeus		<i>Euscirtus concinnus</i>		<i>Gryllotalpa orientalis</i> Burmeister	
	r	byx	r	byx	r	byx	r	byx
Maximum temperature (°C)	0.12NS		0.162NS		-0.087NS		0.11NS	
Minimum temperature (°C)	-0.673**	-0.548	-0.398NS		0.305NS		-0.713**	-0.498
Sunshine (hrs)	0.680**		0.295NS		-0.356NS		0.564*	0.457
Rainfall (mm)	-0.392NS		-0.026NS		0.205NS		-0.368NS	
Morning relative humidity (%)	-0.161NS		-0.357NS		0.283NS		-0.395NS	
Evening relative humidity (%)	-0.701**	-0.112	-0.488*	-0.026	0.366NS		-0.697**	-0.096
Wind Velocity (km/hr)	-0.652**	-0.048	-0.324NS		0.3NS		-0.596**	-0.81
Morning vapor pressure (mm)	-0.688**	-0.537	-0.445NS		0.354NS		-0.728**	-0.488
Evening vapor pressure (mm)	-0.727**	-0.438	-0.520*	-0.106	0.344NS		-0.783**	-0.405
Evaporation (mm)	-0.024NS		0.048NS		-0.077NS		0.1NS	
Number of rainy days	-0.588**	-0.669	-0.402NS		0.378NS		-0.500*	-0.488
* = Significant at 0.05 level ; ** = Significant at 0.01 level; NS = Non Significant								

A. Army worm *Mythimna separate* (Walker)

Mythimna separate is dominant pest of rice and wheat at Jabalpur region. The activity of this pest during June, July and August, September was absolutely nil. Army worm first appeared during 40th SW and attain its first peak in this week (7.28 moths) in light trap tool. The number of moths catches every day was converted into standard weekly average (SWA). After that population sharply declined in 41st SW. It again increases sharply and reached to its second highest peak period on 42nd SW. (9.71 moths). At the time of this period maximum and minimum temperature 31.5°C were 15.4°C individually, whereas morning & evening relative humidity and Vapor pressure were 91.3 percent & 31.6 percent and 13.9 mm & 10.8 respectively. Further sunshine, evaporation and wind velocity were 9.3 hrs. 3.3 km/hrs and 2.5 mm respectively. Population of *Mythimna* then sharply decrease from 43rd SW. Major activity period was October.

In Conformity to the present findings Sharma *et al.* (2013) reported the seasonal incidence of insect pest species of rice namely army worm and noticed these correlations with meteorological parameters. Seasonal incidence indicated that activity period of *Mythimna separate* (walker) was confined between Aug. to Dec. Highest weekly peaks were recorded at the third week of September and month of November in case of *Mythimna separate* show that highest rainfall, lower mean and maximum temperature and higher RH (relative humidity) were favorable climatic conditions for the development of these insect species.

Correlation studies of *Mythimna separate*. The correlation studies of *Mythimna separate* found that minimum temperature, wind velocity, morning vapor pressure, evening vapor pressure, evening relative humidity and number of rainy days showed significant negative correlation (r= -0.673, -0.701, -0.652, -0.688 - 0.727, and -0.588) with insect's catches.

B. Short horn grass hopper, *Tetrix subulata*

Tetrix subulata was first observed in light trap device at the 27th SW (04-07-2016 to 10-07-2016) (0.71 hoppers). The number of hoppers catches every day were converted into standard weekly average (SWA). It is seen in Fig. 2 after the appearance of grass hopper in light trap catches at the 27th, after that pest population were slowly increased and reached to its first peak in 30th Standard week (25-05-16 to 31-07-16) (1.57 hoppers) than population was decreased from 31st to 36th SW (25-07-16 to 31-07-16) (1.57 hoppers) after that pest population was decreased from 31st to 36th SW. Population increased sharply from 41st SW and arrive its second and highest peak period during 43rd SW. (24-10-2016 to 30-10-2016) (4.00 hoppers) afterwards it disappeared. In conformity to the present findings Mishra (2016) reported that seasonal activity of *Tetrix subulata* first observed in light trap during 26th SW. Major activity period was June to December with three distinct peak 32nd SW, 36th SW and 41st SW respectively. In conformity to the present findings Mishra (2016) reported that seasonal activity of *Tetrix subulata* first observed in light trap during 26th SW. Major activity period was June to December with three distinct peak 32nd SW, 36th SW and 41st SW respectively. At the time of highest peak maximum and minimum temperature were 31.7°C and 15.6°C respectively, then morning and evening relatively humidity and vapor pressure were recorded 82.4 percent & 29.3 percent and 12.8 mm & 9.9 mm respectively. Sunshine, wind velocity and evaporation were recorded 8.8 hrs, 2.9 km/hrs and 3.1 mm respectively. Population than decreased sharply in 44th SW. noticeable period was July to October.

Correlation studies of *Tetrix subulata*. Correlation studies revealed that evening relative humidity, evening vapor pressure showed significant negative correlation ($r = -0.488$ and -0.520 , respectively) with hoppers catches. The correlation between *Tetrix subulata* population and maximum temperature, sunshine and evaporation showed positive effect ($r = 0.162, 0.295, 0.048$) and statistically found no significant further minimum temperature, rainfall, morning relative humidity, wind velocity, morning vapor pressure and number of rainy days showed negative effect ($r = -0.398, -0.0265, -0.357, -0.324, -0.445$ and -0.402 with the hopper population and statistically found no significant).

C. Field cricket, *Euscyrtus concinnus*

Euscyrtus concinnus is a minor pest of paddy in Jabalpur and field cricket was first observed during 27th SW (04-07-2016 to 10-7-2016) (32.85 field crickets) in light trap tool. The population of field crickets captured ever day was converted into standard weekly (sw). according to Fig. 3 it is clear that the observance of field cricket in light trap catches at the 27th Standard week, after that population of cricket sharply increased to attain its first and highest peak during 28th SW (11-7-2016 to 17-07-2016) (213.14 crickets). During this period maximum and minimum temperature were 31.1° and 24.5°C respectively, whereas morning & evening relative humidity and vapor pressure were 93.1 percent

and 23.5mm and 23.8 mm respectively. Further sunshine, wind velocity and evaporation were 2.6 hrs. 6.4 km /hrs and 3.0 mm respectively. There was 83.6 mm rainfall during this week which occurred in 6.0 days. After than population sharply decreased in 29th, after that cricket's population again sharply increased and attained to its second peak in 30th SW (25-07-16 to 31-07-16) (132.28 crickets) cricket population was gradually decreased from 31st SW to 42nd Standard week and attained to its lowest level at the 44th SW (3.42 crickets). Observance period was recorded during June to October.

Correlation studies of *Euscyrtus concinnus*. The correlation between *Euscyrtus concinnus* population and minimum temperature, rainfall morning relative humidity, evening relative humidity, wind velocity, morning vapor pressure, evening vapor pressure and number of rainy days showed positive effect ($r = 0.305, 0.205, 0.283, 0.366, 0.3, 0.354, 0.344, 0.378$) but statistically found no significant. In conformity to the present findings Meena (2015) conducted studies on seasonal activity *E. concinnus* (de Haan) and observed its association with weather parameters were found minimum temperature, rainfall, evening relative humidity, wind velocity, morning vapor pressure, evening vapor pressure and number of rainy days showed significant positive correlation, while sunshine show negative effect on field cricket catches.

D. Mole cricket, *Grylotalpa orientalis*

Grylotalpa orientalis was first observed in light trap device at the 26th Standard week (27-6-2016 to 3-7-2016) (0.85 crickets). From the Fig. 4, we are clearly seen that after the appearance of mole cricket's population in light trap catches during 26th SW, population than slightly increased and attained to its first peak during 30th Standard week. Population than gradually declined from 31st SW to 41st, population of crickets than sharply surge and attained to its second and highest peak 43rd standard week (17-10-16 to 23-10-2016) (8.71 cricket). In the time of this period maximum and minimum temperature was 31.7°C and 15.6°C respectively, although morning & evening relative humidity and vapor pressure were 82.4 percent & 29.3 percent and 12.8mm & 9.9 mm. Sunshine, wind velocity and evaporation were 8.8 hrs., 2.9 km/hrs. and 3.1 mm respectively. Rainfall doesn't occur this week. Population of crickets than sharply reduce in 44th standard week. Crucial incidence duration was June to October. In accordance with the present findings Wang *et al.* (2012) reported that the mole cricket (*Grylotalpa* sp.) had two damage peaks (late May to early July, early September to mid and late October) at Hangzhou (China).

Correlation studies of *Grylotalpa orientalis*. The correlation studies revealed that, minimum temperature, evening relative humidity, wind velocity, morning vapor pressure, evening vapor pressure, and number of rainy days showed significant negative correlation ($r = -0.713, -0.697, -0.596, -0.728$ and -0.500 respectively) with population of cricket's catches. While sunshine showed significant positive correlation ($r = 0.457$) with cricket catches.



Mythimna separata (Family- Noctuidae)



Tetrix subulata (Family- Tetrigidae)



Gryllotalpa orientalis (Family-Gryllotalpidae)



Euscyrtus concinnus (Family -Gryllidae)

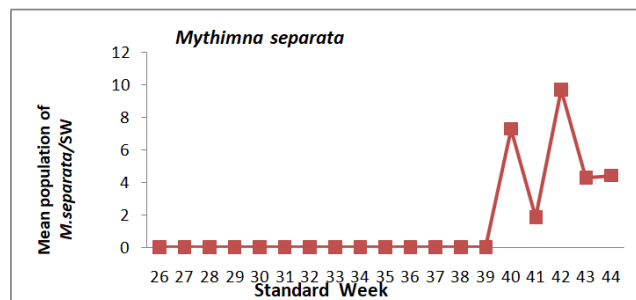


Fig. 1. Mean population of *Mythimna separata* in light trap during kharif season (June to October).

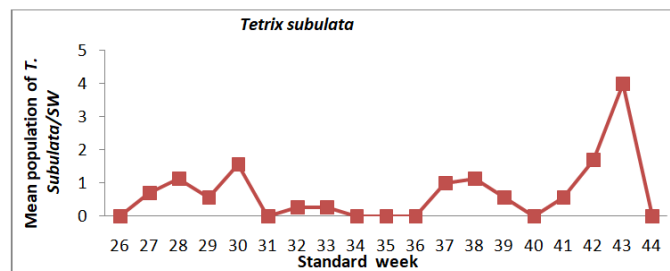


Fig. 2. Mean population of *Tetrix subulata* in light trap during kharif season (June to October).

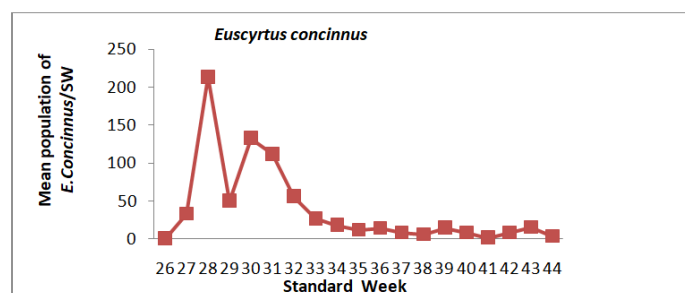


Fig. 3. Mean population of *Euscyrtus concinnus* in light trap during kharif season (June to October).

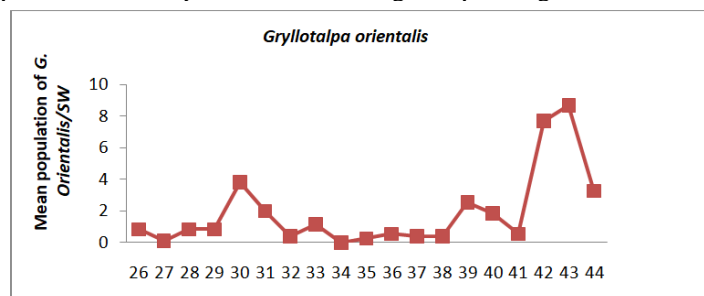


Fig. 4. Mean population of *Gryllotalpa orientalis* in light trap during kharif season (June to October).

CONCLUSIONS

Seasonal incidence of harmful insect's pest of rice was done by operative the light trap device in *kharif* season of 2016. Recorded crucial activity period of *Mythimna separata* was first appeared during 4th standard week and attain its peak in this week (7.28 moths) in light trap. Population then sharply decrease from 43rd SW to 44th SW, major activity period was October. Short horn grass hopper was first observed in light trap during 27th SW (0.71 hoppers). Major activity period was July to October. *Euscyrtus concinnus* is a minor pest of rice crop in Jabalpur and other region also, it was first observed during 27th SW, major activity period was June to October. *Gryllotalpa orientalis* was first observed in light trap tool in the 26th SW (0.85 crickets). Population than sharply declined in 44th SW. Major activity period was June to October. The correlation studies revealed that four major pests in relation to different meteorological parameters such as, maximum temperature, minimum temperature, sunshine, evening and morning relative humidity, wind velocity, morning vapor pressure, evening vapor pressure, rainfall and number of rainy days.

Acknowledgement. The author is express his heartfelt gratitude to Dr. Amit Kumar Sharma (Associate Professor), Dr. A.K. Saxena (Professor), Department of Entomology and Dr. Sambath, Zoological survey of India, Jabalpur (M.P.). For their guidance, support and suggestion and regular encouragement during the course of investigation.

Conflict of Interest. None.

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How to cite this article: Sanju Singh, Amit Kumar Sharma, Naresh Dhakar, Mitesh Makwana and Dheerendra Mahor (2023). Seasonal Activity and Population Dynamics of *Mythimna separata*, *Tetrix subulata*, *Euscyrtus concinnus* and *Gryllotalpa orientalis* in Rice in Relation to Meteorological Parameters. *Biological Forum – An International Journal*, 15(10): 566-570.